

**MOBILE DATA TERMINALS AND AUTOMATIC VEHICLE LOCATORS IN
THE FIRE SERVICE-TOOLS OR TOYS**

Executive Leadership

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ABSTRACT

The problem in the Alameda Fire Department is that we are trying to determine if mobile data terminal's (MDT) and global positioning systems and automatic vehicle locators (GPS/AVL) in our fire apparatus will decrease response times and give us more tools in the field to manage emergencies.

The purpose of this applied research project was to determine what effect MDT and GPS/AVL technology has on fire apparatus response times, identify tools that Command and Company Officers can use in emergency management and any negative aspects to using MDT and GPS/AVL technology.

During this course of study descriptive research was used, which involved extensive literature review of the National Fire Academy Learning Resource Center, the World Wide Web, trade journals, interviews with subject matter experts and local libraries. These sources were used to answer four applied research project questions.

1. Which major metropolitan public safety organizations are using MDT and GPS/AVL technology?
2. What tools are available for Command Staff and Company Officers in the field using MDT and GPS/AVL technology?
3. What are the negative aspects of using MDT and GPS/AVL technology?
4. What is the effect on response times using MDT and GPS/AVL technology?

The procedures used included defining key words used in the research, interviewing subject matter experts in major metropolitan public safety agencies and researching printed materials.

The results found that MDT's with on board routing decreases fire apparatus response times when using Geographical Information Systems software. It determined that there are some negative aspects to using MDT's and GPS/AVL technology, such as lost satellite signals when inside building, in the Urban Canyons of metropolitan cities and when parked under large tree limbs and other vegetation.

The recommendations are to implement MDT and GPS/AVL technology in the Alameda Fire Department. Establish a Financial Committee and a Technical Committee to implement the project. Conduct a pre and post MDT and GPS/AVL response time study to quantify the reduction.

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INTRODUCTION

The problem in the Alameda Fire Department is that we are trying to determine if mobile data terminal's (MDT) and global positioning systems and automatic vehicle locators (GPS/AVL) in our fire apparatus will decrease response times and give us more tools in the field to manage emergencies.

The cost of implementing MDT and GPS/AVL technology is costly and we need to ensure that it will benefit our first responders. The current financial situation in California and the City of Alameda has forced use to tighten our budgets and be very analytical regarding the purchasing of new technology.

Our next generation computer aided dispatch (CAD) has the ability to interface with MDT and GPS/AVL technology to track fire apparatus locations. The CAD then would identify the closest appropriate unit to be dispatched to the incident, rather than by nearest fire station.

The purpose of this applied research project is to determine what effect MDT and GPS/AVL technology has on fire apparatus response times and identifies tools that Command and Company Officers can use in emergency management.

During this course of study descriptive research was used, which involved extensive literature review of the National Fire Academy Learning Resource Center, the World Wide Web, trade journals, interviews with subject matter experts and local libraries. These sources were used to answer four questions.

1. Which major metropolitan public safety organizations are using MDT and GPS/AVL technology?

2. What tools are available for Command Staff and Company Officers in the field using MDT and GPS/AVL technology?
3. What are the negative aspects of using MDT and GPS/AVL technology?
4. What is the effect on response times using MDT and GPS/AVL technology?

BACKGROUND AND SIGNIFICANCE

This research project is a requirement of the National Fire Academy Course titled Executive Leadership. The topic was selected because it has direct relevance to the City of Alameda and the Executive Leadership Course.

The City of Alameda is located in the San Francisco East Bay Area on an island that is separated by an estuary from the City of Oakland. The Alameda Fire Department (AFD) was organized in 1876 and was entirely a volunteer fire department with several fire companies scattered throughout the island city until 1906.

In the late 19th century and early 20th century the fire service was much less complex as compared to today's fire service organizations. The incidents they usually responded to were wildland or structure fires.

The AFD of today consists of 110 paid professional firefighters that protect a diverse population of 73,500. The AFD staffs five paramedic engines, two trucks, three paramedic ambulances, one rescue/fireboat, one technical rescue truck and a command vehicle from five fire stations. Today's fire service responds to much more complex incidents, such as hazardous materials spills and acts of terrorism requiring multiple agency response and the use of modern technology to respond to today's service demands.

The AFD is a member of the Alameda County Regional Emergency Communications Center (ACRECC) located at Lawrence Livermore National Laboratory in Livermore California. ACRECC provides a full service emergency dispatch services for the members of ACRECC. The center provides services to Alameda County Fire Department, City of Alameda Fire Department, City of San Leandro, City of Dublin, City of Fremont, Lawrence Livermore National Laboratory, City of Union City, Lawrence Berkeley National Laboratory and Camp Parks Army Training Post. ACRECC dispatches approximately 85,000 calls for service annually and has an annual budget of 2.5 million dollars.

ACRECC members are currently in contract with Intergraph Public Safety to implement a new CAD system. The CAD will support MDT and GPS/AVL technology. It also supports GIS mapping, paging and a number of other features. The target implementation date for the CAD system is April 6, 2006.

Fire and EMS agencies thrive on information, they need it to respond, anticipate what they'll encounter on-scene and to predict trends and patterns. In the "old" days, information was gathered by officers in the field, transmitted to others via paper notes, reports and other notations, and then filed in metal cabinets. Now, of course, the computer has taken over most of the data collection, transmission, dissemination and storage duties, especially in light of the Sept. 11th terrorist attacks it's all about mobile data now.

A big part of this computerization is moving the collection and dissemination of data out to field units usually in vehicles, although hand held units also exist. In the 1990s, commercial applications of data began to bloom, especially among package

delivery and service companies who needed to dispatch their fleets. Consumer applications for mobile data began to appear, in the form of alphanumeric pagers, personal digital assistants and even wireless phones. Slowly, the link between the radio systems and terminals was broken. Companies began providing mobile data radio networks for a fee, and other companies began to specialize in terminals, mounting hardware, and software applications including in-field reporting, records management and links to CAD (Wyler, T, E, 2004).

Now, mobile data is focusing more on consumers than businesses, pushed by the availability of mounds of information on the Internet (Wyler, T, E, 2004).

LITERATURE REVIEW

This literature review was conducted to determine what information was contained within published literature and interviewing subject matter experts that would be applicable to answer the following four applied research questions.

#1 Which major metropolitan fire service organizations are using MDT and GPS/AVL technology?

During this course of research interviews were conducted with four major metropolitan public service organizations to answer the following questions.

1. When did your department implement MDT and GPS/AVL technology?
2. What vendor did you contract with for your hardware?
3. Have you conducted any studies on response time's pre-MDT and GPS/AVL and post MDT and GPS/AVL?

4. What additional tools do you use in your MDT terminals, such as software applications and Internet access?
5. Are there negative aspects to using MDT and GPS/AVL technology?

The following four departments were interviewed to answer the above questions.

- Dallas Fire Rescue, Dallas Texas
- Fort Lauderdale Police Department, Fort Lauderdale Florida
- Fort Worth Fire Department, Fort Worth Texas
- Phoenix Fire Department, Phoenix Arizona

Dallas Fire Rescue implemented MDT and GPS/AVL technology in 1992. They currently are using a variety of MDT hardware, such as Motorola MW 520's and Panasonic Tough Book notebook computers. They use Trimble GPS/AVL hardware because of its ability to be programmed.

Dallas Fire Rescue has not conducted any pre and post MDT and GPS/AVL response time studies. They also could not note any negative aspects of using MDT and GPS/AVL technology. They do not have any additional tools in there MDT's, such as software applications (Morrison, D., personal communication, April 4, 2005).

The Fort Lauderdale Police Department implemented MDT and GPS/AVL technology in 2000. They are currently in the process of implementing MDT and GPS/AVL technology in the fire department. They are using the Panasonic Tough Book notebook computers. They use the Trimble GPS/AVL technology due to its reliability and flexibility to be programmed.

Fort Lauderdale Police Department has not conducted any response time analysis due to the nature of police department response patterns.

One negative aspect noted by Fort Lauderdale was that they experience disconnects between the MDT and there server. Their solution to this is to implement radio Internet Protocol for communications between their CAD and MDT's (Maracota S., personal communication, April 4, 2005).

The Fort Worth Fire Department implemented MDT and GPS/AVL technology in January 2003. They use a Tiburon CAD and MDT system. The interviewee did not know what GPS/AVL technology was being used.

The Fort Worth Fire Department has not conducted any pre or post response time analysis. They do not use other software applications or internet access on their MDT's.

The Fort Worth Fire Department has experienced the negative aspect of lost signals in the GPS/AVL system. They stated that it occurred when apparatus are in quarters or in a area were the GPS signal is weak (Brown J., personal communication, April 4, 2005).

The Phoenix Fire Department implemented MDT's in 1982 and GPS/AVL technology in 1994. They are using Motorola MDT's and are transitioning to the Panasonic Tough Book notebook computer. They use Trimble GPS/AVL hardware due to its reliability.

The Phoenix Fire Department uses a variety of software applications, such as mapping programs and fire incident software.

The Phoenix Fire Department has not conducted any response time analysis on pre and post MDT and GPS/AVL technology.

The negative aspect of MDT and GPS/AVL technology noted by Phoenix was maintenance and support of the hardware and software. The mapping software and target hazard information needs to be updated frequently due to the growth in the city and surrounding areas. The hardware needs replacement periodically due to the nature of its rugged use in fire apparatus (Strong L., personal communication, April 4, 2005).

#2 What tools are available for Command Staff and Company Officers in the field using MDT and GPS/AVL technology?

They need to know, ‘How do I get there, where am I currently, what is the route to the call,’ Malone said, “adding that when first responders arrive at an incident, they also need to see what other units are on the scene and where they're positioned”.

“Onboard routing software with up-to-date mapping information helps get first responders to incidents faster”, Middleton said. Area agencies expect response time to improve even more next year, when the interface between the CAD system and the Intelligent Traffic Management System operated by the Texas Department of Transportation is implemented.

While field personnel need to reach no further than the mobile computer's hard drive for map data, they can also reach across a wireless network for data from other sources. Along with details about a specific incident drawn from the CAD system, additional key information might include data from their agency's administrative systems, state and local government databases, subscription-based databases and selected sites on the public Internet. “A first responder might use the system, for example, to look up information about hazardous materials”, Malone said (Merrill 2004).

The CAD system also had a direct impact on Phoenix firefighters. MDT's were mounted in all emergency apparatus, and a station-alerting package was installed in each fire station. These additions affected our firefighters primarily in two ways. First, they now had a text copy of the dispatch message, a hard copy from the station printer and a soft copy on the MDT screen, reducing the chance of speaking or hearing errors that could affect response times. Second, they were able to change the status of their unit from their MDT, thereby reducing overall radio time and freeing the dispatcher to manage more activity. Using an MDT, firefighters also perform two-way messaging; receive supplementary call information; view rudimentary building drawings; preplan tactical information; and research information stored in the CAD, such as active incidents, incident histories, and the status of other units (Anderson, 2002).

Field Software Inc. offers a software application called FDonScene. The application runs on MDT's and provides tools for Incident Commanders. FDonScene tracks Divisions, Groups and Units on the scene. It accounts for every person, and apparatus that is equipped with the integrated accountability feature. Incident Commanders can check off and monitor benchmarks, assign objectives and tasks with a single mouse click, manage and document RIC assignments and operations. Timers can be set to prompt Incident Commanders to track their strategy and tactics (Field Soft, 2005).

Tactical response planning in an urban setting requires street network data, information on hazardous materials locations, and pre-fire survey information such as floor plans or hydrant location and capacity data. The Winston-Salem Fire Department in North Carolina implemented a system that uses ruggedized PCs mounted on emergency

vehicles that run a custom GIS application. The application displays a map showing the optimal route to the emergency. This route can be instantly modified to take into account streets that are blocked. The application also provides information on all available fire hydrants, any known hazardous materials in the area, the locations of special needs populations, and other pertinent information. A touch screen lets firefighters pan and zoom on the map and use icons that link the Geographical Information System application to additional information such as floor plans, diagrams, or other pre-fire survey information (ESRI, 1999).

3. What are the negative aspects of using MDT and GPS/AVL technology?

Some negative aspects identified by Trimble Technology are that training is required and retraining as technology changes. Urban canyon building's can block satellite signals, heavy foliage and thick branched trees can weaken or block the satellite signal (Lewis, R. 2004).

The main disadvantage of a GPS system is high maintenance cost once the system is installed. Installation should be in places where there is minimal disturbance due to effective antenna spaces. Most GPS based technologies are based on dipole antenna systems, which require the antenna coil to stick out of the system, and might not be suitable for all tracking applications. The unit is of considerable size most often requires special shelf be built for installing the transponder system and is limited to rough handling. Since the system is comprised of very sophisticated electronics on board the entire unit must not be handled roughly. Currently, all GPS based tracking systems are limited to vehicle tracking and tracking of expensive cargo (Lewis, R. 2004).

GPS units receive satellite signals that contain a satellite's position information, from a network of satellites orbiting the earth. The GPS unit then calculates its own position by triangulating among the different satellites,, using the time it takes the signal to beam down from three or more satellites and using the position of the satellite. The GPS needs the signal from at least 3 satellites to calculate the unit's position. Satellite coverage can be difficult in areas where terrain or other obstacles block the satellite signal, such as in vehicles, canyons, amidst tall buildings, or heavy trees.

#4 What is the effect on response times using MDT and GPS/AVL technology?

A business may be interested in saving time when making deliveries and a public safety agency wants to improve response time to emergency calls. Both can be accomplished through dispatch control. Trimble Navigation, Sunnyvale, CA, installed a GPS based GPS/AVL system for the Schaumburg, IL, police department. Operators can now immediately dispatch and automatically track every vehicle in the fleet, helping police get to the scene quickly. Dispatchers can locate the closest available unit. Or if a car is delayed en route, the operator can quickly find the nearest available backup unit.

Having that much control over a fleet also helps to monitor progress on a task, and errors and mistakes can be observed and quickly corrected. For example, with a real-time map display, a dispatcher recognizing a vehicle taking a wrong turn can advise the driver.

The same theory can be applied to help drivers find hard to locate addresses. Seattle's Shuttle Express started using a GPS/AVL system last year on all its 66 vehicles. It dubbed the system, installed by Corp Ten International, Baltimore its "Guardian

Angel." The system helps drivers find addresses when picking up passengers, and it helps dispatchers estimate when vans will arrive at SEA-TAC Airport.

Driver safety is another GPS benefit. Emergency alerts are offered by most GPS/GPS/AVL systems. A driver can press a button that will immediately alert the dispatcher of an emergency, and the system will display and record the exact location of the vehicle.

Desert Empire Transfer & Storage uses Teletrac's Fleet Director to ensure driver safety. The southern California trucking company manages a fleet of 26 tractors and 32 trailers.

A GPS/AVL system also helps to supervise personnel. "There's also the inherent, what they call, 'phantom supervisor' effect," Kruse said. "The operators know they'll be accountable for where those vehicles were and for how long. Drivers have more motivation to stay on task" (Chandler, 1998).

In the El Paso Fire Department the GPS/AVL locator system tracks the location of the department's apparatus fleet. This system consists of a radio and a GPS receiver/transceiver affixed to each fire apparatus. A signal from the GPS/AVL unit is transmitted to a satellite, the signal bounces back to earth, and the radio system tells the computer system exactly where that unit is on a map to within one meter of accuracy. The GPS/AVL computer then informs computer-aided dispatch which unit is closest. That's where the principal benefit, a decrease in incident response time, comes in. The department previously dispatched units based on the fire station closest to an incident. With this technology, it's able to send the closest unit available to take the call.

The Phoenix Fire Department, which includes fire and emergency medical dispatching services for 18 fire departments across the Valley of the Sun, also uses GPS technology for automatic vehicle location tracking to provide continual apparatus locations, even while units are traveling, to ensure that the closest appropriate unit is dispatched. GPS/AVL is directly related to a decrease in response times in emergencies. Fire Chief Mike Merwick explains that the Lincoln Fire Department serves a 70-square-mile area, in which fire loss amounts to about \$2.6 million a year. Although he doesn't believe that mobile data terminals are that beneficial for control or suppression in this size area, he does expect the digital GPS/AVL to be a great help (Page, 2003).

PROCEDURES

Definitions Automatic Vehicle Locators

Technology that uses global positioning systems to track the location of vehicles.

Geographical Information System

Technology that manages, analyzes, and disseminates geographic knowledge.

Global Positioning Systems

Satellites that transmit signals that are used for extremely accurate three-dimensional global navigation.

Mobile Data Terminal

A computer located in a vehicle used to transmit and receive data from a computer aided dispatch system.

Research Methodology

The purpose of this applied research project is to determine what effect MDT and GPS/AVL technologies has on fire apparatus responses times and identify tools that Command and Company Officers can use in emergency management.

The topic Mobile Data Terminals and Automatic Vehicle Locators in the Fire Service-Tools or Toys was selected because our next generation CAD will have the ability to use MDT and GPS/AVL technology. With the current budget short falls in the City of Alameda we needed to be sure that the significant investment in this type of technology would be useful to out first responders.

During this course of study descriptive research was used, which involved extensive literature review of the National Fire Academy Learning Resource Center, the World Wide Web, trade journals, interviews with subject matter experts and local libraries. These sources were used to answer the four applied research questions.

Interviews were conducted with subject matter experts in large public safety agencies in the United States. The agencies that were selected have implemented this technology and have a used it for several years. The selection procedure for them was random. Telephone calls were made to large metropolitan public safety agencies and if they used MDT and GPS/AVL technology the subject matter expert in that agency was interviewed. The following subject matter experts were interviewed.

- Lt. Kincaid, Dallas Fire Rescue, Dallas Texas
- Sgt. Maracota, Fort Lauderdale Police Department, Fort
Lauderdale Florida
- Jerry Brown, Fort Worth Fire Department, Fort Worth Texas

- Lance Strong, Phoenix Fire Department, Phoenix Arizona

The interview was structured and all the participants were asked the same questions verbatim and follow up questions after the last question.

Limitations

The limitation observed during this research was that there is a limited amount of literature published regarding response time studies pre MDT and GPS/AVL and post MDT and GPS/AVL implementation. After an exhaustive research there was not one public service agency that had conducted this type of study.

RESULTS

The following results were found during the literature review.

- #1 Which major metropolitan public safety organizations are using MDT and GPS/AVL technology?

The following major metropolitan public safety organizations were included in the applied research project. Within the United States there are many more than four, but for the purpose of this research the following organizations were used.

- Dallas Fire Rescue, Dallas Texas
- Fort Lauderdale Police Department, Fort Lauderdale Florida
- Fort Worth Fire Department, Fort Worth Texas
- Phoenix Fire Department, Phoenix Arizona

The following questions were asked to all four agencies.

1. When did your department implement MDT and GPS/AVL technology?

The Phoenix Fire Department implemented MDT technology in 1982 and GPS/AVL in 1994.

Dallas Fire Rescue implemented their MDT and GPS/AVL technology in 1992.

The Fort Lauderdale Police Department implemented their MDT and GPS/AVL technology in 2000.

The Fort Worth Fire Department recently implanted their MDT/AVL technology in 2003.

2. What vendor did you contract with for your hardware?

The Phoenix Fire Department is using Motorola MDT's and is transitioning to Panasonic Tough Book notebook computers.

Dallas Fire Rescue uses a variety of MDT's, such as Motorola MW 520 and Panasonic Tough Book notebook computers.

The Fort Lauderdale Police Department is using Panasonic Tough Book notebook computers.

The Fort Worth Fire Department uses a Tiburon CAD and MDT system.

3. Have you conducted any studies on response time's pre-MDT and GPS/AVL and post MDT and GPS/AVL?

None of the four agencies have conducted pre-MDT and GPS/AVL and post MDT and GPS/AVL response time studies.

4. What additional tools do you use in your MDT terminals, such as software applications and Internet access?

The Phoenix Fire Department uses a variety of software applications., such as mapping software, target hazard information and fire incident software.

Dallas Fire Rescue, Fort Lauderdale Police Department and the Fort Worth Fire Department do not use any additional software in their MDT's.

5. Are there negative aspects to using MDT and GPS/AVL technology?

The negative aspect of MDT and GPS/AVL technology noted by Phoenix was maintenance and support of the hardware and software. The mapping software and target hazard information needs to be updated frequently due to the growth in the city and surrounding areas. The hardware needs replacement periodically due to the nature of its rugged use in fire apparatus

One negative aspect noted by Fort Lauderdale was that they experience disconnects between the MDT and there server.

The Fort Worth Fire Department has experienced the negative aspect of lost signals in the GPS/AVL system. They stated that it occurred when apparatus are in quarters or in an area where the GPS signal is weak.

Dallas Fire Rescue did not have any negative aspects with MDT and GPS/AVL technology.

#2 What tools are available for Command Staff and Company Officers in the field using MDT and GPS/AVL technology?

First Responders need to know how to get to the incident location and this is done through on board routing software that shows the quickest route to an incident, therefore reducing response times. The GIS software also allows responding fire apparatus and Incident Commanders to see where other units are located at the incident and en route.

With MDT's the first responders can access CAD data in the field, such as information on all available fire hydrants, any known hazardous materials in the area, the locations of special needs populations, and other pertinent information. With a soft copy of the dispatch information on the MDT screen it reduces the chance of speaking or hearing errors that could affect response times. With MDT's first responders are able to change the status of their unit with a touch of the screen, thereby reducing overall radio time and freeing the dispatcher to manage more activity.

Field Software Inc. offers a software application called FDonScene. The application runs on MDT's and provides tools for Incident Commanders. FDonScene tracks Divisions, Groups and units on the scene. It accounts for every person, and apparatus that is equipped with the integrated accountability feature. Incident Commanders can check off and monitor benchmarks, assign objectives and tasks with a single mouse click, manage and document RIC assignments and operations. Timers are set to prompt Incident Commanders to track their strategy and tactics.

Touch screens on MDT's allows firefighters to zoom in and out on the map and use icons that link the GIS application to additional information such as floor plans, diagrams, or other pre-fire information.

#3 What are the negative aspects of using MDT and GPS/AVL technology?

In cities with tall buildings next to each other that cause the Urban Canyon affect, the GPS satellite signal can be weakened or blocked; this causes the GPS unit to lose contact with the dispatch center. Other materials that can block or weaken the satellite signals are heavy foliage, thick-branched trees and apparatus parked in fire stations.

The main disadvantage of a GPS system is high maintenance cost once the system is installed. The GPS unit is of considerable size most often requires special shelf be built for installing the transponder system and is limited to rough handling.

The Phoenix Fire Department noted that the maintenance of the MDT's and the GIS map requires continuous updating due to new growth and the updating of pre-fire building plans.

#4 What is the effect on response times using MDT and GPS/AVL technology?

Businesses are interested in saving time when making deliveries and a public safety agencies wants to improve response time to emergency calls. Both are accomplished through dispatch control. Dispatchers can immediately dispatch and automatically track every vehicle in the system, helping public safety personnel get to the scene quickly.

In the private sector having that much control over a fleet also helps to monitor progress on a task, and errors and mistakes can be observed and quickly corrected. For example, with a real-time map display, a dispatcher recognizing a vehicle taking a wrong turn can advise the driver.

Driver safety is another GPS benefit. Emergency alerts are offered by most GPS/GPS/AVL systems. A driver can press a button that will immediately alert the dispatcher of an emergency, and the system will display and record the exact location of the vehicle.

A GPS/AVL system helps to supervise personnel. There's also the inherent phantom supervisor effect. Personnel know they'll be accountable for where their vehicles are and for how long.

The El Paso Fire Department uses a GPS/AVL locator system tracks the location of the department's apparatus. The GPS/AVL computer then informs computer-aided dispatch which unit is closest. The principal benefit is a decrease in incident response time. The department previously dispatched units based on the fire station closest to an incident. With this technology, it's able to send the closest unit available to take the call.

The Phoenix Fire Department, which includes fire and emergency medical, also uses GPS/AVL technology to track all apparatus locations, even while units are traveling, to ensure that the closest appropriate unit is dispatched. GPS/AVL is directly related to a decrease in response times in emergencies.

DISCUSSION

First Responders need to know how to get to the incident location and this is done through on board routing software that shows the quickest route to an incident, therefore reducing response times. The GIS software also allows responding fire apparatus and Incident Commanders to see where other units are located en route and at the incident (Merrill, 2004). This is becoming more important every day especially in urban and suburban areas where rapid growth is taking place. It is not possible to commit to memory or look in a map book the location of all the streets in our jurisdictions. The GIS mapping software tells us where to go. The difficult task is keeping all the information current in the GIS system, like streets and floor plans (Strong, personal communication, April 4, 2005).

Not only do first responders need to know how to get there they need additional tools and information to assist in emergency management in these complex times. Being able to change your unit status from your MDT reduces overall radio time and freeing the

dispatcher to manage more activity. Using an MDT, firefighters can perform two-way messaging; receive supplementary call information; view rudimentary building drawings; preplan tactical information; and research information stored in the CAD, such as active incidents, incident histories, and the status of other units (Anderson, 2002). These tools are a tremendous value to first responders. Currently, my organization uses wall maps and hard copy pre-plans. The introduction of this technology would greatly enhance your response capability.

Having a software application that tracks Divisions, Groups and units on the scene and accounts for every person would reduce stress on Incident Commanders that manually track those functions. Incident Commanders can check off and monitor benchmarks, assign objectives and tasks with a single mouse click, manage and document RIC assignments and operations. Timers can be set to prompt Incident Commanders to track their strategy and tactics (Field Soft, 2005).

There have been negative aspects identified in this research when using MDT and GPS/AVL technology. The GPS signal can be blocked in areas that are surrounded by large buildings or large branches and foliage and when apparatus are parked in fire stations (Lewis, R., 2004). The advantages of GPS/AVL technology far outweigh the negative aspects that were identified. To have the ability to track all fire apparatus in a CAD system and dispatch the closest unit rather than the closest fire stations will reduce response times (page, 2003).

A GPS/AVL system helps to supervise personnel. There's also the inherent phantom supervisor effect. Personnel know they'll be accountable for where their vehicles are and for how long (Chandler, 1998). As supervisors it is important to know

where your resources are located. This would be easy to do with an MDT. With a glance at a MDT screen you could know what the status of your resources are and where they are.

The organizational implications of this study will clearly identify the need to transition to this technology. It has met the purpose of the research. It determined that MDT and GPS/AVL technology will reduce response times and give our Incident Commanders and Company Officers additional tools to manage emergencies.

RECOMMENDATIONS

- It is recommended that based on the outcome of this applied research project the Alameda Fire Department implement MDT and GPS/AVL technology.
- It is recommended that a pre and post MDT and GPS/AVL study be conducted to quantify the reduction in response time. This study would be available to any agency and posted on our web site.
- Establish a Finance Committee and a Technical Committee to implement the project.
 - Technical Committee to determine the hardware and software requirements, initial startup costs and annual maintenance costs. This will be completed through a Request for Information and Request for Proposal process. Develop a project time line to track all tasks from the start of the project through implementation.

- Financial Committee will research funding sources, such as grants and lease purchasing plans and coordinate with the Technical Committee.

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of the others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed_____